Highlights

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Washington SCIENCE TRENDS

SPACE COMMUNICATION PROGRAMS

Defense Department, through the Advanced Research Projects Agency, is sponsoring intensive research and development in the field of communications satellites. Objective is a system specifically tailored to military requirements of reliability, security and resistance to interference or jamming.

Here is a summary of programs and requirements as presented to Congress:

* Communications are planned between any points on the surface of the Earth, including the Polar Regions.

* Communications are planned between any point on the Earth's surface and aircraft or ships.

* Broadcast service is planned whereby military information or orders can be instantly transmitted to all military elements.

Project Courier: First firing will be made within a year for the Courier Project, an outgrowth of the delayed communication repeater experiment conducted last December with an orbiting Atlas Vehicle. Roy Johnson, Director of ARPA, reports that the system will have a traffic handling capacity equivalent to 20 continuously operating teletype channels of 100 words per minute. Satellites will pass over ground stations at relatively low altitude, picking up,storing and transmitting traffic on command. As each shot goes into orbit, it will be subjected first to a period of R&D testing to determine improvements which should be incorporated in later tests. Each satellite will then be made available for operational testing. Program development is expected to take three years.

Polar Communication Project: First test firing to put a satellite in orbit for this project is expected in two years, with development work to be completed in three years. The system, which will require several satellites in orbit, is designed to provide communications between ground points in the U.S. and aircraft in the Polar Regions.

Equatorial Real-Time Repeater: Initial firings, to test various subsystems, will be made in a year and a half, with final full test firings to begin in about three years. This satellite, at a distance of 19,400 nautical miles from Earth, is planned to travel in its orbit at a speed such that the rotation of the earth keeps the satellite fixed with respect to any point on earth. Communication capability of 144 voice channels is planned, in addition to one voice channel for use to aircraft.

COMMUNICATIONS RESEARCH

A "thorough, detailed" program of basic and applied research in the communications field is currently being planned by ARPA and its civilian counterpart, the National Aeronautics and Space Administration. The program will be closely coordinated with the forthcoming satellite communication experiments. Two major general areas of research are:

* Propagation Studies: Investigations are planned in the area of propagation of electromagnetic energy through space and between space and the earth and its surrounding ionosphere. Information is particularly sought on the propagation characteristics of electromagnetic spectrum as it relates to atmospheric and ionospheric conditions, auroral disturbances, position, and other conditions.

* Environmental Studies: Here, the emphasis will be placed on the effect of the spacial environment on electronic equipment. Among the subjects to be surveyed are the energy distribution of solar energy in the visible and infrared regions and particularly in the ultraviolet and soft X-Ray regions. Research is planned on long-term variations in these factors, such as effects during periods of solar storms. The effects of particles and micrometeorites will also be investigated.

GOVERNMENT RESEARCH POLICIES

Bureau of the Budget has set forth basic policies to be followed by Government agencies in the use of cost-reimbursement type management and operating contracts with non-profit institutions, private businesses, or universities. Such contracts call for administration of Government R&D programs, operation of Government-owned or leased industrial facilities or certain personal or professional services.

Bureau sees these advantages in such contracts:

Special knowledge -- "Management and operating contracts have been found particularly useful for the performance of functions requiring specialized knowledge and experience in large-scale industrial management or in the conduct of research."

Speed --"Management and operating contracts have been employed successfully when unusual speed has been required in the organization of a new program or service."

Research by educational institutions may suffer from one key provision of the new policies. Budget Bureau says contracting agencies "should consider other feasible alternatives and contractors before requesting an institution of higher learning directly to administer a large-scale applied research and development facility, under an operating and management contract, particularly if the work is concerned with development and testing."

(Complete text available without charge. See Publications Checklist)

PILOT DATA PROCESSOR

Logical design of a new Pilot Data Processor has been completed at the National Bureau of Standards and construction of the equipment is underway. The Pilot was designed to provide a flexible, multi-purpose facility with a wide repertoire of logical and computing capabilities.

Realistic simulation of a large number of different kinds of data processing systems under consideration for Government applications will be possible. Among these are:

* Business-type data processing, where the system performs accounting, record-keeping and information retrieval operations for management purposes.

* Scientific data reduction, where the system performs complex mathematical and logical manipulations on the data.

* Control applications, where the system is used for real-time control and simulation operations in conjunction with analog computer facilities or with automatic instrumentation facilities -- remotely located if necessary.

* Data processing network applications, where the system communicates with other digital computer facilities to form a communication network in which all the computers collaborate on large-scale problems that are beyond the capacity of any one machine.

Pilot System is built up of eight major blocks -- the primary computer, primary storage, secondary computer, secondary storage, input-output control, external storage, input-output units such as readers, printers and displays and the external control containing special features that facilitate communication with human operators and with devices external to the system.

Speeds fully comparable or better than most modern large-scale commercial computers are envisioned as the result of logical design said to be unique. The arithmetic speed derives in large part from a novel type of parallel adder connected to a diode-capacitor memory reported to be capable of providing one random access per microsecond.

(Report available. Free. Write National Bureau of Standards, Office of Technical Information, Washington 25, D.C. for Summary Tech. Report No. 2297)

ATOMIC INSTRUMENTS: Commerce Department estimates there are $30 to $40 million worth of nuclear radiation and detection instruments now in use and that these represent only about 15 percent of the total market potential. The Government survey shows that about 100 companies are presently producing nucleonic instruments, but that most specialize in a limited number of types.

(Brief report available. Write Information Office, BDSA, U.S. Department of Commerce, Washington 25, D.C. for Report BD-59-35)

RESEARCH CHECKLIST

( ) Isotopic Dating: Atomic Energy Commission is sponsoring research and development at Goodyear Tire and Rubber looking toward industrial applications of isotopic dating. The techniques are expected to have particular value for items, such as airplane tires, which have limited storage and service lives. Preventive maintenance applications are also envisioned for such items as electronic tubes and circuit components, electrical insulation and delicate mechanical parts of complex computer systems. The process is said to have been made feasible by recent development of ultrasensitive low level counting devices.

( ) Ozone Production: Research sponsored by the Department of Defense has led to development of a laboratory method for the efficient conversion of oxygen to ozone. The process involves electrical dissociation of oxygen in a microwave discharge near a surface cooled with liquid nitrogen. It is believed to be applicable to large scale commercial use. Ozone is a major oxidizing agent in purification, bleaching and other industrial processes.

(Details free. Write National Bureau of Standards, Office of Technical Information, Washington 25, D.C. for Summary Tech. Report No. 2310)

( ) Aviation Research: Cornell Aeronautical Laboratory, Buffalo, N.Y. is currently flight-testing a Navy-sponsored local air-traffic-control system designed to bring aircraft onto carriers at precisely controlled intervals. The WOTCU (Wave Off and Transition Control Unit) is built around a digital computer and transmits commands for speed, heading and altitude to individual aircraft every few seconds. Each aircraft is assigned a definite block or "bucket" or air space in a hexagonal pattern. When aircraft are cleared to land, these "buckets" move toward the carrier in single file, as in an endless conveyer belt.

(Details from Cornell Aeronautical Laboratory, Information Services, Buffalo 21, N.Y.)

( ) Rocket Motor Research: Studies at Princeton University sponsored by the Air Force have led to development of a new type flow reactor useful in the study of combustion processes in rocket motors. The device permits study of reactions too fast for classical kinetic techniques and too slow for shock tube experiments. A complete study of ethylene oxide decomposition was included in the research.

(Report available. Write OTS, U. S. Department of Commerce, Washington 25, D.C. for PB 131 932. 20 pages. 75 cents)

( ) Uranium Fuel Elements: Research by General Electric at the Atomic Energy Commission's Hanford plant has led to development of a production line technique said to accurately test aluminum jackets on uranium fuel elements. A new device ultrasonically tests the integrity of the bonding between the uranium cure and the jacket, measures the jacket's thickness by means of eddy currents and rejects faulty units.

( ) Glass Research: Heat resistant glass of optical quality has been developed for the U.S. Air Force at the National Bureau of Standards. The glass is required for glazing windows in supersonic aircraft so that visual and photographic observations can be made with a minimum of distortion. The zinc borosilicate glass-forming system was investigated for resistance to both high temperature and thermal shock.

(Report available. Free. Write National Bureau of Standards, Office of Technical Information, Washington 25, D.C. for Summary Tech. Report No. 2316)

( ) Saline Water Conversion: Department of Interior has selected a multiple-effect distillation process for the first saline water conversion demonstration plant. One million gallons a day of sea water is expected to be converted to fresh water at a cost of less than $1 per thousand gallons. The process selected is known as long-tube vertical multiple effect distillation, common to the chemical and salt industry. W.L. Badger & Assoc. of Ann Arbor, Mich., proposed the process. Interior Department hopes to advertise for bids on the new plant early next year.

(Details from Information Service, Department of The Interior, Washington 25, D.C. Ask for P.N. 51030)

( ) Titanium Research: Research at the U.S. Army Watertown (N.Y.) Arsenal indicates that internal oxidation of cerium in titanium produces "significant" benefits in the strength of titanium for service about 500°C.

(Report available. Write OTS, U.S. Department of Commerce, Washington 25, D.C. for PB 131 788. 15 pages. 50 cents)

( ) Packaged Scintillation Detector: Investigations at the Naval Research Laboratory have led to development of a self-contained battery powered scintillation detector. Considerable improvement was reported when this device was substituted for the conventional ac-operated unit formerly used, which had resulted in a poor signal to noise ratio.

(Details from Nucleonics Division, Naval Research Laboratory, Washington 25, D.C.)

( ) Rocket Fuel Research: Studies by Odin Associates, State College, Pa. for the Air Force have resulted in a "promising" method for preventing overheating of the external structure of a rocket powered aircraft or missile traveling at hypersonic speeds within the atmosphere. Rocket fuel is used for maintaining the structure at manageable temperatures. The absorbed aerodynamic heat is also said to produce a "significant" augmentation of the thrust of the rocket engine.

( ) Submarine Detection: Defense Department is currently re-evaluating all non-acoustic methods of submarine detection. With rare candor, the study is known as "Project Unsound."

PUBLICATIONS CHECKLIST

( ) Management and Operating Contracts, a circular establishing the Government's official position on cost-reimbursement type contracts with non-profit institutions, private businesses or universities, particularly for research and development. 6 pages. Free. (Write Publications Office, Bureau of the Budget, Washington 25, D.C. for Circular No. A-49)

( ) Organosilicon Compounds, a comprehensive Russian summary, translated by the U.S. Air Force, of the chemistry and uses of organosilicon compounds. Covers methods of preparation and physical and chemical properties. Discusses applications in such fields as electronics, metal coatings, lubricants and hydraulic fluids, plastics, precision castings and textiles. 920 pages. $10. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for Pub. No. 59-11239)

( ) Scientific Publications, an index covering the years 1955-58 prepared by CERN, the European Organization for Nuclear Research and classifying its various publications. A useful guide. Free. (Write CERN-Scientific Information Service, Geneva 23 --Cern, Switzerland)

( ) Rare Metals, a survey prepared by Research Chemicals, Inc. for the Air Force based on unclassified literature. Covers abundance and distribution, recovery from ores and purification, reduction to metal and the properties of the rare earth metals and their compounds. 174 pages. $3. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for PB 151 311)

( ) Inhabitable Artificial Atmospheres, a bibliography and abstracts prepared by the Ohio State University Research Foundation for the U. S. Air Force. A survey of unclassified world literature useful for space and submarine technology and including material on human biology and medicine, botany, microbiology and zoology. 154 pages. $3. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for PB 151 277)

( ) Space Agency Patents, first of a series of proposed regulations on patent and invention rights involved in contracts with the National Aeronautics and Space Administration. 16 pages. Free. (Write NASA, Public Information Office, 1520 H Street, N.W., Washington 25, D.C. for Interim Waiver Regulations)

( ) Aircraft Radiation Damage, a cataloged and cross-indexed bibliography prepared by Inland Testing Labs, Chicago for the U.S. Air Force on radiation effects on materials in connection with the Aircraft Nuclear Propulsion program. Reviews over 10,000 documents. 215 pages. $9.60 in microfilm, $33.30 in photocopy. (Write Chief, Photoduplication Service, Library of Congress, Washington 25, D.C. for PB 135 128)

( ) Radar Towers, a guide to Air Force radar towers in general use and those under design and development. Includes general and special features of each tower, but not actual design of tower structures. 61 pages. $3.90 in microfilm, $10.80 in Photocopy. (Write Chief, Photoduplication Service, Library of Congress, Washington 25, D.C. for PB 134 986)